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THE EARLY DAYS OF THE FIRST ASTRONOMICAL OBSERVATORY IN CANADA

BY J. E. KENNEDY

IN the minute book of King's College, Fredericton, the following entry appears, dated March 19th, 1851—"a report was read from the committee appointed to superintend the erection of the Observatory, stating that the building had been completed at a cost of £170–9–7. Ordered that the report be accepted."

The existence of this Observatory is due to the efforts of the pioneer Canadian astronomer, William Brydone Jack. From the Genesis of the University of New Brunswick (Raymond, 1919), the following has been extracted: "William Brydone-Jack was in many respects an admirable representative of the Scottish race. He possessed the strong moral fibre characteristic of his ancestry, the rugged tenacity of purpose and strong common sense, the courage and perseverance, the cheerful optimism and energy essential to successful leadership. As a young man he was endowed with an unusually fine physique. He was tall—rather more than six feet in height—strong and vigorous. He liked life in the open air, was an excellent walker, and almost as much at home in practical surveying as he was in the lecture room, or in the College observatory. He was fond of working in his garden, liked and drove spirited horses and enjoyed the game of curling. He was an entertaining companion, interested in the affairs of the day, and in the well-being of the community, patriotic in his sentiments and social in his instincts. For many years he was an active member and office bearer in the Saint Andrews Society. He was at his best on the occasion of any public function and even those students who had little love for mathematics and stood in awe of the Doctor in the class-room, were proud of him when he presided at the Annual Encaenial festival. He was a brilliant mathematician,

quick and accurate in his work and exceedingly neat in his diagrams both on paper and at the black-board. It was always a surprise to the assembled class to see the ease and accuracy with which the Doctor with graceful free arm movement would draw upon the black-board a perfect *ellipse*.

"He had the gift of *sarcasm* and was not always patient with the duller intellects in his classes. Unfortunately in the curriculum of those days there were no optional subjects and there were always certain students to whom the pass-mark of twenty-five per cent in *Analytics* and *Calculus* was a veritable night-mare. But to the "mathematicians" of the various classes there was a never to be forgotten charm in the Doctor's manner in the lecture-room. While pre-eminent in mathematics, he was an all-round scholar. Of this we have ample proof in the Encaenial addresses that have come down to us. It may also be noted that upon the death of the Classical Professor, George Montgomery-Campbell, in April, 1871, Dr. Jack solved a problem that had arisen respecting the work with the senior class by himself taking the subject of Classics with the seniors for the balance of the year.

"Previous to a serious attack of congestion of the lungs in the winter of 1866–67, from the effects of which he never entirely recovered, the Doctor did a good deal of field work in connection with the course in surveying. He also made much use of the observatory. This modest little building was built in 1851. Its fine equatorial telescope, made by the famous Merz & Sons, was for some time the best in British North America, and the other astronomical accessories were regarded *then* as quite up to date. The many hundreds of careful observations which Dr. Jack took show that astronomical work was to him a labour of love. He was always particularly interested in any discovery or invention pertaining to science. After the establishment of lines of telegraph communication he was among the first to make use of them in determining with accuracy differences of longitude. By exchange of signals with Professor Bond of Harvard University, the true longitude of Fredericton was ascertained. He afterwards, at the request of the New Brunswick government, obtained the exact longitude of Saint John. In 1856, as discrepancies were found to exist in the longitude of places in the Northeastern boundary between Maine and New Brunswick, as taken by the British and the United States surveyors, it was deemed important to settle the points at issue by the electric telegraph. Accordingly the longitudes of Grand Falls and Little Falls (or Edmundston) were determined by this method. The longitude of Quebec was determined in a similar way in November, 1855.

"After the establishment of a meteorological observatory at the University, soon after the Confederation of the provinces, daily observations were made by Dr. Jack until he retired from the Presidency of the College in 1885."

What inspired Brydone Jack to undertake the construction of this modest little Observatory? It may have been the influence of Sir David Brewster, under whom he studied at St. Andrew's University in Glasgow. It may have been the encouragement he received from the Lieutenant Governor of New Brunswick, Sir Edmund Walker Head. Wherever the inspiration came from, one doubts if Dr. Jack realized initially the magnitude of his undertaking nor the results that would materialize from being "first" in this scientific field. Let us examine the order in which the early observatories in Canada came into existence.

Records show that as late as the year 1835, there were no observatories in the Western Hemisphere (Tory, 1939). This was a matter of concern to Admiralty officials in London who depended on such stations for the accurate determination of time and for fixing of positions. It was decided that the instruments from the dismantled Observatory at St. Helena should be overhauled and sent to Upper Canada. The Imperial authorities built the first Observatory in Canada at Toronto in 1839, but it was primarily a magnetic Observatory and did not acquire a telescope for astronomical work before 1881.

The present Dominion Astronomer, Dr. C. S. Beals, very carefully searched the accounts of the founding of the Observatory at Toronto to determine whether any astronomical instruments had been incorporated in the original building. From an early picture of the Observatory, he found that there was no indication of a dome where proper astronomical instruments could have been mounted. There was a small extension to the building where a surveyor's theodolite was placed, presumably to get azimuths in connection with the magnetic measurements of declination. He stated that "in my opinion, there is no reasonable doubt that the Fredericton Observatory is the oldest astronomical Observatory in Canada."

The construction of other observatories in Canada followed; in 1850, Lt. Ashe was appointed Astronomer at Quebec and a small Observatory was completed there in 1854 (Tory, 1939). The citizens of Kingston were stimulated by a solar eclipse of the same year to secure a telescope and start astronomical observations there by 1857.

What type of building is the First Astronomical Observatory in Canada? Two pictures, taken of the Observatory in the early days of its existence, have been presented to the Archives section of the U.N.B.

Library quite recently. While no attempt has been made to assign an accurate date to this reproduction, one can safely assume that it is mid-nineteenth century and not later than 1870.

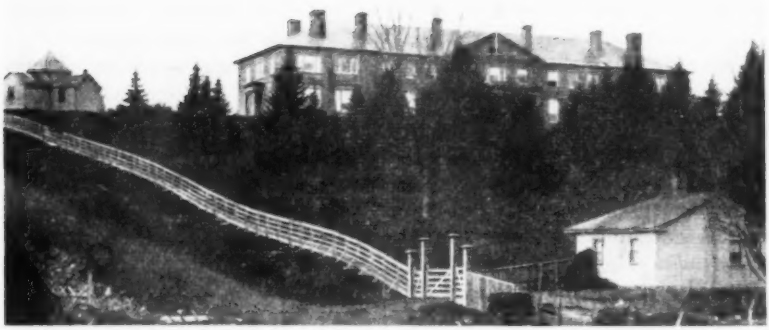

FIG. 1—An early photograph of the First Astronomical Observatory in Canada, located on the campus of the University of New Brunswick. In addition, the Arts Building which is the oldest existing university building in Canada, is also shown.

Last year, the Astronomer Royal, Sir Harold Spencer Jones, uncovered a sketch plan of the original building while the Archives of the Royal Greenwich Observatory were being searched for correspondence from Dr. Jack. In June 1854, Brydone Jack had submitted this plan, attached to a letter to the Astronomer Royal. An extract from this letter states: "I also avail myself of the present opportunity to give you an account of a small Observatory which I have had constructed on a very economical plan for King's College, thinking it might be useful to some amateur astronomers who might wish to erect similar buildings. It is built of wood and consists of an octagonal tower for the equatorial, 14 feet across, and two wings, each 12 feet square."

Whether any observatories were built in other countries from this sketch plan and are still in existence is unknown. The author is not aware of a building of similar construction in either the United States

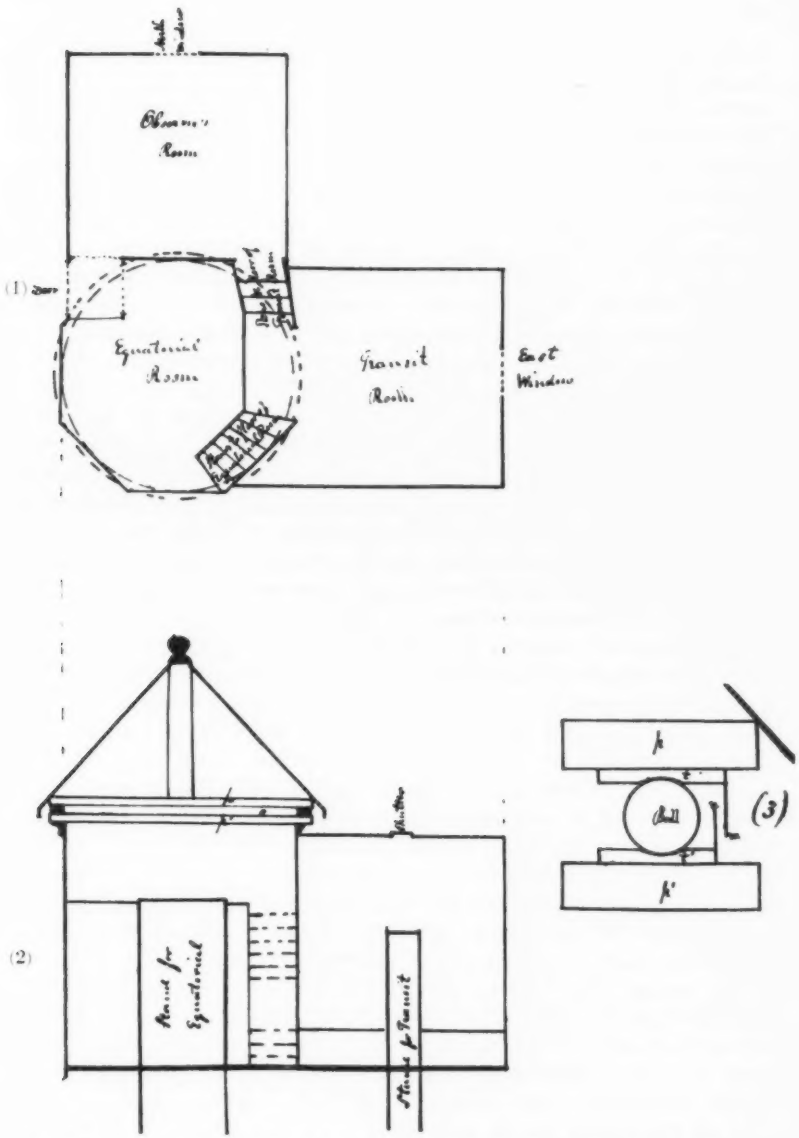

FIG. 2—In this sketch, details of the ground floor plan are given in (1), while (2) is a section through the ridge of the transit room, and (3) is an enlarged section through the plates showing the tracks and balls on which the roof rotated.

or Canada. The eight-sided dome and pyramidal roof tend to make its construction unique.

It is interesting to read the data recorded over a century ago as Brydone Jack persuaded the governing body of King's College to devote the funds required for building and equipping this modest Observatory. In March 1847, a Council report showed that "the sum of £550 sterling may be devoted to the object in view which they recommend should be appropriated as follows—namely £300 for the Mathematical Department to be applied in the purchase of a good 7 feet achromatic Telescope" ... In June 1847, the Council of King's College ordered that "the further sum of £50 sterling be appropriated for that object (telescope) if required."

Within a year, this same Council decided "that the Telescope now proposed by Professor Jack at an original cost of £336 sterling, with the building and apparatus necessary for its proper use, are more than the wants of the College require or the funds will warrant." A Committee was authorized to make arrangements for annulling the order and to get the best instrument at a cost not exceeding £100 sterling over and above that sum of £110 sterling already advanced to the manufacturer.

One can visualize that the committee experienced considerable difficulty with the manufacturer over the annullment of this order. In October 1848, a letter was read to the Council from Messrs. Merz of Munich and the Registrar was immediately ordered to "adopt measures for getting the telescope." The instrument arrived in New Brunswick in May 1849, and was given the following acclaim in the New Brunswick *Courier* newspaper:

"This splendid instrument, we hear, is perfect in every part, and has been pronounced by competent judges to be of the very highest order. The original cost, we likewise learn, was about £650 currency—we hail the possession of such an instrument as this, by any institution in the Province, as a great public boon, and we rejoice to find that such an excellent addition has been made to the apparatus with which our Provincial University is already amply provided."

The Journal of the House of Assembly for New Brunswick, in the year 1854, gives a consolidated listing of all apparatus in the College and amounts spent on Philosophical Apparatus in the seven years 1846–1853. It clearly states that "the last sum includes £504–11–9 paid for the Telescope." This amount should be regarded as more reliable than the one quoted by the newspaper.

The decade, 1851–61, following the completion of the building, may long be regarded as the most glorious years of the U.N.B. Observatory.

Brydone Jack must have displayed a tremendous energy, drive and enthusiasm in that period. There is no question that the founding of the Observatory quickened the interest in practical surveying, which prompted the University to start courses in Engineering Instruction in 1854. During the years, 1854–56, Dr. Jack was busily engaged in using the "electric telegraph" for the determination of longitude of various centres in the Province. Signals were exchanged with Professor Bond at Harvard Observatory. Then, because of a slight discrepancy in the values taken by the British and American surveyors, numerous exchanges of correspondence followed between Dr. Jack, the Astronomer Royal, Professor Bond, and Lt. Ashe at Quebec. An effort is being made to collect the relevant material to determine how this problem was settled.

Perhaps even better than many who have followed him, Brydone Jack realized that a University, without adequate library facilities and essential Philosophical apparatus, could never inspire nor arouse a thirst for knowledge in its students. Hence, it is not surprising to read the following extract in the University Calendar for the year 1864–5.

"In the Observatory there is a large Achromatic Telescope of 6″ clear aperture and 7½ feet focal length, by the celebrated makers, Merz & Son of Munich. It is equatorially mounted, and provided with clock-work motion, and a delicate and beautifully constructed Wire Micrometer for measuring the relative positions of double and multiple stars. It has also a Double Ring Micrometer and eye-pieces of various kinds, magnifying from 90 to 500 times. It is sufficiently powerful to exhibit all the principal objects of interest in the heavens, and for size and efficiency is unequalled by any Telescope in British North America. In the Transit-room of the Observatory there are two very superior sidereal Chronometers, and a thirty-inch Transit instrument by Troughton & Simm, of London. The other Astronomical and Geodetical Instruments, by the same makers, are—a fine Altitude & Azimuth Instrument, with four Micrometer Microscopes, a large Theodolite with two Telescopes; a Gravatt's Level with Levelling Staves, and an eight-inch Sextant with artificial Horizons and Stand. The University is probably far better provided with Optical Instruments than any Institution of the kind in the British Provinces."

All of these instruments have not yet been located, but the large equatorially mounted telescope and micrometer eyepiece are nearly restored to operating conditions. The historic transit instrument has been preserved and its stone pillar, together with base casting, may at some future date be replaced in its original position in the Observatory.

There is still hope that other items among this equipment may be found.

A small volume in the Archives of the University Library contains the following (Bailey): "A modest monument in the Old Burying Ground marks the last resting of Dr. Jack, of Manus the Mathematician. Requiescat in pace."

With the recent unveiling of the plaque on the First Astronomical Observatory in Canada (Kennedy, 1955), a fitting memorial has at last been dedicated to the many achievements in astronomy of William Brydone Jack.

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RE-OPENING OF THE PULKOVO OBSERVATORY LENINGRAD, U.S.S.R., MAY 20–22, 1954*

By W. S. McClenahan

Re-opening ceremonies of the Pulkovo Observatory, completely destroyed during the war, were held at Leningrad May 20 to 22, 1954. Invitations to attend were extended to astronomers and scientists in many parts of the world. It was my privilege to receive one of the invitations sent to Canada, and the Department of Mines and Technical Surveys very kindly gave permission for me to attend.

As I was travelling by plane, it was necessary to spend the night at Helsinki, Finland, and the next afternoon when I reached the airport I found D. H. Sadler and Prof. T. G. Cowling, from England, Dr. Dirk Brouwer and Dr. J. J. Nassau from the United States, Dr. André Danjon and D. Chalonge from France, and Prof. J. H. Oort from Holland, waiting to travel to Leningrad by the same plane.

From Helsinki travel was by Soviet plane to Leningrad and from that time till leaving Moscow on June 4, all the delegates from Canada, the United States, Mexico, England, many of the European countries and China, were guests of the U.S.S.R. Everything was provided for us and we were entertained in a very cordial and sumptuous fashion.

Soviet Astronomers Zverev and Nemiro met the plane at Leningrad and after passport formalities had been completed we were taken to the Hotel Astoria. On the following day, May 20, the delegates were taken on a bus tour of the city, seeing many points of interest some of which were visited at greater length after the meetings were concluded.

At six o'clock p.m. we gathered in the auditorium of the Russian Academy of Sciences to hear addresses of welcome by Prof. I. P. Bardin, President of the Russian Academy of Sciences, speaking in place of A. N. Nesmejanov who was ill, and Dr. A. A. Mikhailov, Director of the Pulkovo Observatory.

Inauguration services took place at the Pulkovo Observatory which is situated about ten miles south of the city of Leningrad. Transportation was provided and each day a small fleet of cars left the hotel taking delegates to the meetings. The opening ceremonies took on the traditional form of ribbon cutting by Prof. I. P. Bardin, similar to our own Canadian ceremonies. Many hundreds of people were present, photographers were numerous and no restriction was made on the delegates

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about taking pictures. I recall only one place in Leningrad where we were requested not to take pictures.

After the Observatory had been officially declared open the delegates assembled in the very fine assembly hall with seating accommodation for approximately two hundred people. Messages of good will were given by men from many countries. Prof. P. Th. Oosterhoff spoke on behalf of Prof. O. Struve, president of the International Astronomical Union; Dr. Dirk Brouwer on behalf of the United States of America; D. H. Sadler, England; the Director of the Chinese Academy of Science, China, presented a very beautiful banner with the inscription, "The Astronomical Capital of the World"; Prof. B. Lindblad, Sweden; Prof. J. H. Oort, Holland; Prof. A. Danjon, France; Soviet astronomers from other Soviet observatories; Prof. C. Hoffmeister, East Germany; H. S. Jelstrup, Norway; representatives from Bulgaria, Hungary, Belgium, Roumania and Mexico. I had the privilege of speaking for Canada.

The afternoon was spent in visiting the various instruments. Many of the older ones, famous for long series of observations, had been remounted and were actually in use again. Some new telescopes were in place; a 26-in. refractor made in Germany; an eight-inch meridian circle, the latter to be used in a programme of observations on faint stars for fundamental work; and a new polar telescope designed by Dr. A. A. Mikhailov. A new horizontal transit instrument was set up in one of the observing pavilions and in the same room the Ertel transit circle was again in use. In the same pavilion with the eight-inch meridian circle is a broken-type transit used for the time service. This is equipped with a photoelectric cell developed by Prof. Pavlov, an application for which he received the Stalin Prize in 1947. Main reliance was placed on pendulum clocks of the Shortt free-pendulum type. This was true also at the Sternberg Institute in Moscow. Two quartz clocks were in use there and they expected to have six other quartz clocks of Soviet make.

Other instruments mounted and in use were a 20-in. Maksutov Schmidt-type telescope provided with spectrograph and means for spectrophoto electric registration; and a new beam-type interferometer with altitude, azimuth mounting, used in double-star measurements.

After the first day, the conference divided into two groups, one on astrometry and the other on variable stars. The sessions of papers continued until May 26th. We were given the privilege of visiting any of the instruments we were interested in, and questions were answered through our interpreters who were ever solicitous to see our every need was satisfied. They were with us on nearly all occasions as the language

barrier proved a serious handicap. When the meetings were within walking distance many walked back and forth.

Many papers were contributed by members of the staff of the Pulkovo Observatory and dealt with various phases of Position Astronomy. Our interpreters tried to give us a current translation as the paper was presented, and generally a summary was made in either English or French. Amongst those given by visiting delegates was one by Prof. Danjon on "Determination of Time and Latitude." The writer gave a short summary of the results with the Ottawa photographic zenith tube.

Soviet astronomers contributed many papers also at the conference on variable stars and names remembered by the writer were V. A. Ambartsumian, P. P. Parenago, B. V. Kukarkin. Contributions by foreign delegates were given by Dr. J. J. Nassau, Prof. J. Oort, Prof. P. Th. Oosterhoff and others. Resolutions were proposed at the close of the conferences with recommendations as a guide for future plans of research in astrometry and variable star work.

For our entertainment we were taken to the theatre, and saw operas and ballets (one being Swan Lake in the Bolshoi Theatre in Moscow) which were very enjoyable. An interesting excursion took us to Peterhof for the spring opening of the many fountains. Thousands of people assembled there, many took their lunches and apparently it is a day looked forward to each year. The palace and the grounds suffered heavy damage under German occupation and had been restored since the war. When completed the Summer Palace is to be a museum. A banquet was given for all delegates at which Prof. V. A. Ambartsumian and Dr. P. G. Kulikovsky presided. Other visits were made to the Winter Palace, now an annex of the Hermitage, Lomonosov Museum, Palace of Fine Arts and other places. In these museums are many beautiful paintings and other articles dating back many centuries.

We left Leningrad on May 29th and were flown to Moscow which was "en fete" for the 300th anniversary of the Union of the Ukraine. In this connection we were taken the next morning to see a parade on the famous Red Square. This proved to be a parade of infantry, artillery, mechanized equipment, planes overhead, sportsmen and sportswomen, and then finally, members of civilian societies in native costumes by the thousands carrying banners and flowers, completely filled the square as they marched past. Marshal Bulganin took the salute of the troops before the march past started. Other Soviet officials were assembled at the Mausoleum where the bodies of Lenin and Stalin lie in state. From my hotel window I could see, at various times during my seven days in Moscow, long lines of people queued up waiting to

enter the Mausoleum. On the afternoon one of our guides took me through, we were in line for an hour and at that we "crashed" the queue about half way.

Our visit to the Sternberg Institute in Moscow, and the new Moscow University, proved to be very interesting. The latter is a magnificent structure on the outskirts of Moscow. We were given figures to indicate the magnitude of its work. There are twelve faculties, 18,000 students, 2,000 teachers and professors, 6,000 students in residence, and only twenty-five per cent of students applying can be accommodated. Ninety-six per cent of the students receive a stipend of 300 roubles per month in first year, and pay 15 roubles per month for a room, books are free of charge and other grants are received for buying scientific books.

The "old" Sternberg Institute, founded in 1831, is now completely surrounded by the city. City lights interfered so that photographic work became impossible. For this reason the telescopes are being moved to a new site near the University. The buildings were in the process of construction when we visited it, one telescope was already in place and semi-circular pavilions for a meridian circle and transits were completed as well as the azimuth mark hut. The location should prove a very convenient one for close co-operation with the University.

The main Soviet Time Service is at the Sternberg Institute. Observations are made there for the determination of time. The main clocks consist of four Shortt Free-Pendulums, three other similar clocks made in Russia, and two quartz clocks. More quartz clocks are expected to be developed in the near future. Their time room was quite congested with equipment but this will be remedied when they move to their new quarters.

Another point of interest visited was the Tretaykovoff Gallery where there is a very fine collection of paintings, many of them of biblical incidents. On the day we left Moscow we were taken for a tour of the Kremlin. This proved very interesting. Here again the palace and the cathedrals dating back many centuries are now used as museums, filled with ancient and valuable articles relating to the history of Russia. A reminder of more recent struggles in the life of Russia are the graves on the Red Square, just outside the Kremlin walls, of the Brothers slain in the 1917 Revolution.

The return journey, from one of the most fascinating trips I ever had, started on June 4th when all the English-speaking delegates left by Soviet plane and were flown to Helsinki where connections were made with the other air lines.

I was impressed by the magnitude of the Soviet accomplishments

in restoring the astronomical instruments and buildings at Pulkovo. Soviet astronomers were most anxious to further the exchange of publications and each delegate was given a considerable number of text books and recent publications.

Finally I wish to express my thanks to the Dominion Government for permitting me to attend the meetings and to the Soviet Government for providing my free expense stay while in the Soviet Union.

ALBERT EINSTEIN

May 14, 1879—April 18, 1955

By C. A. Chant

To many persons Einstein is known as the author, or the inventor, of the Theory of Relativity which he applied to the solution of problems met in attempts to "explain" the ultimate nature of the Universe. This will always be considered his greatest achievement; but during his life he made many contributions to scientific subjects and these, omitting entirely his discussion of Relativity, would allow him to be one of the greatest of scientists.

Einstein was born at Ulm, a town of some 50,000 persons in Wurtemberg, which is one of the most southerly of the states of Germany. It adjoins Switzerland on the south and Bavaria on the east. His parents were Jewish. His boyhood was spent at the great city of Munich (pop. 600,000), which is 63 miles south-east of his birthplace. Here his father had electro-chemical works.

In 1894 the family migrated to Italy, but Albert remained behind. He attended school at Aarau in the canton of Aargau, which adjoins the canton of Zürich, with its chief city of the same name (pop. 200,000). These are all in the north part of Switzerland. As he grew up he gave instruction in mathematics and physics in the polytechnic school in Zürich and at the same time attended lectures there until 1900. Next year he acted as tutor at Schaffhausen. The canton of Schaffhausen, the smallest in Switzerland, adjoins the canton of Zürich on the north.

From 1902 to 1909 Einstein was an examiner of patents in the patent office at Berne, and he became a citizen of Switzerland. During this period he took his Ph.D. and he published his first papers on physical subjects. His very first paper was "On the electrodynamics of moving bodies". Also (in 1905) he published "On the Special Theory of Relativity". In 1909 he was made Extraordinary Professor of Theoretical Physics in the University of Zürich; and in 1911 he was given the chair of Physics in Prague, but the very next year he returned to the polytechnic at Zürich as full professor. Thus he received rapid recognition.

In 1913 a special position was created for him. He was made Director of the Kaiser Wilhelm Institute at Berlin, with the understanding that he was to give all his time to research.

Einstein published important papers on the Brownian motion, the quantum theory, the photoelectric effect, the variation of heat with temperature and other physical questions. His genius for investigation had

a wide range but it seemed to favour profound fundamental problems. "The General Theory of Relativity" was published in 1915.

Numerous honours were bestowed on Einstein. He was elected to many scientific societies and honorary degrees were conferred on him in many lands. Among these distinctions were an honorary degree from Princeton University in the U.S.A., the Gold Medal of the R.A.S. in England and a Nobel Prize in Sweden.

One of the most noted hypotheses in physics developed in the nineteenth century was the wave theory of light. According to it the various optical phenomena are due to wave-motion which, of course, must be in a medium, and as we receive light from near objects and also from the distant, this must fill all space. It was called the ether. Through this the earth and other bodies of our system must sweep—like the wind through a grove of trees!

About 1887 Michelson of Chicago invented his form of interferometer which he saw at once should be able to detect and measure the motion of the earth with respect to the ether. The experiment was tried and the result was *null*. Michelson and Morley and after them several others tried a similar experiment; in every case the result was *null*. Fitzgerald in 1893 and Lorentz in 1895 suggested that the apparatus changed its linear dimensions when in motion through the ether. Einstein in 1905 suggested that there might be a true law to the effect that "it is of necessity impossible to determine absolute motion by any experiment whatever". This is the hypothesis of relativity.

In 1915 Einstein published his "General Theory of Relativity", and he gave three tests to which it might be submitted:

1. The rotation in its own plane of the perihelion of Mercury's orbit, according to actual observation, is 43″ per century, but the calculation by Newton's theory of gravitation indicates that it should be about 7″. Einstein on his theory made this amount to be 42″.9.
2. A ray of light which comes from a distant star and passes near the edge of the sun is bent, in its passage near the sun, by 1″.745.
3. There is a gravitational shift in the spectral lines from a star which is dependent on the mass of the star.

The quantities to be measured in the last two tests are very small and the experiments are difficult but the general conclusion is that they have verified the theory.

Philipp Frank was successor to Einstein as professor of physics at Prague and afterwards came to Harvard University. At the time of Einstein's death he gave, over the radio, interesting facts about him, some of which are quoted from *Sky and Telescope* for June 1955:

Einstein often said he was basically interested in philosophy which he regarded as a part of physics.

He tried to develop his ideas in a very general way. Thus arose the idea of changing mass into energy. A hundred years ago we had the conservation of energy in physics and conservation of matter in chemistry. Out of Einstein's researches came the formula $E = mc^2$, where E is energy, m is mass and c is the velocity of light (186,000 miles per second in English units). From this comes naturally "Chain reaction".

From early years he was interested in freedom of the mind and he was against all oppression. As a child he was frightened at a military parade. Later he became a noted pacifist.

He had a certain antipathy to being paid for research, thinking that a paid scientist might feel pressed to produce results that would not be his best work. He would rather earn his living with his hands at a plumber's or shoemaker's job, and do his thinking on his own time.

To his students he had no office hours. They could consult him any hour of the day. The time they would take was small, and then he would go back to his own ideas, which were always in his mind. It was not easy to become his close friend, but he enjoyed behaving as an ordinary person and talking with plain people rather than with dignitaries.

On his first visit to New York he was already at the peak of fame. Reporters came on board his ship and of course asked him to explain Relativity in a few sentences. He suggested the following:

Before the Theory of Relativity people believed that if all material bodies were to disappear from the universe—men and rocks and everything—then, nonetheless time and space would still exist. Relativity says this is not true. If all material bodies were to disappear, time and space would disappear, too. That is the essence of Relativity.

In 1929 Einstein published a short paper on what he called a Unified Field Theory. He attempted to find a simple mathematical expression to represent the laws of gravitation and electro-magnetism. It was not entirely satisfactory; and although in 1950 and again in 1953 he announced that he was near the goal, the solution eluded him.

In 1932 Einstein was appointed Professor of Mathematics and Theoretical Physics in the Institute for Advanced Study at Princeton, N.J. It was originally intended that Einstein would spend half of each year in Berlin. But the Nazis were more powerful in Germany and indeed they had destroyed the house that the Einsteins had lived in. Thus it came about that Einstein spent the rest of his life in the United States.

On the eve of the Second World War Einstein, realizing well that the Nazis might do great damage by using the discoveries in atomic physics, urged President Roosevelt to undertake the production of the atom bomb. Thus one who was considered the outstanding pacifist of his time initiated the atomic age in warfare.

Einstein died in his sleep. His body was cremated.

OTTAWA LATITUDE RESULTS FOR 1954*

By M. M. Thomson

The variation of latitude for Ottawa during the year 1954 has been determined at the Dominion Observatory using observations with the photographic zenith telescope. The mean results have been tabulated and a diagram has been prepared indicating the motion of the pole over an interval of nearly two years. The adopted values of longitude and latitude for Ottawa are $5^h\ 02^m\ 51^s.940$; 45° 23′ 38″.7 N.

In a report published last year[1] it was indicated that the locus of the earth's instantaneous pole of rotation describes a roughly circular path. Co-ordinates, designated as *X* and *Y*, for the position of the pole at certain epochs each year are given by the International Latitude Service after a study of results from a particular group of five observatories located around the world at latitude 39° N. *X* is measured along the Greenwich meridian, while *Y* is measured along the meridian 90° west. At least two stations, located on meridians differing by nearly 90°, are necessary to determine values of *X* and *Y*. However, if one assumes that the pole follows a strictly circular path for short intervals, an approximation to the truth may be arrived at from observations made at a single station.

The Chandlerian period of polar motion is about 14 months. On this criterion the location of Ottawa is such that the instantaneous pole of rotation crosses the Ottawa meridian about three months before crossing the zero meridian, and two weeks after crossing the meridian 90° to the west of zero. Hence the *X* and *Y* co-ordinates of the pole for any epoch may be deduced by adopting the value of latitude variation at Ottawa three months earlier (*X* co-ordinate) and two weeks later (*Y* co-ordinate) than the date in question. These have been tabulated in Table I and plotted, the resulting polhode for 1954 being shown in figure 1. One may note that if the values in column *X* are moved up about 0.3 of a year, they will correspond closely to the *Y* column.

The PZT latitude results are grouped into fortnightly means and plotted. A smooth free-hand curve drawn through the plotted points then provides the adopted values.

The table and the accompanying figure show that as the geographic pole moves about its mean position, both the latitude and longitude along any meridian undergo changes. At the equator longitudes remain

*Contributions from the Dominion Observatory, vol. 2, no. 19.
[1]*R.A.S.C. Jour.*, vol. 48, p. 169, 1954.

TABLE I

Date	Latitude	X	Y	P.V.
1954.00	45° 23′ 38″.60	+″.25	−″.20	+s.019
.05	.47	+ .21	− .29	+ .018
.10	.39	+ .14	− .35	+ .015
.15	.34	+ .06	− .40	+ .011
.20	.29	+ .00	− .42	+ .007
.25	.28	− .10	− .43	+ .001
.30	.27	− .23	− .41	− .008
.35	.31	− .31	− .35	− .015
.40	.37	− .36	− .27	− .019
.45	.46	− .41	− .18	− .024
.50	.54	− .42	− .08	− .026
.55	.65	− .43	+ .01	− .028
.60	.73	− .39	+ .07	− .027
.65	.78	− .33	+ .12	− .024
.70	.83	− .24	+ .17	− .019
.75	.88	− .16	+ .19	− .014
.80	.88	− .05	+ .18	− .006
.85	.87	+ .03	+ .17	− .001
.90	.86	+ .08	+ .16	+ .003
.95	.85	+ .13	+ .12	+ .007
1955.00	.81	+ .18	+ .07	+ .011

steady, but the variation increases with increasing latitude, reaching a maximum at the poles. Time determined from star transits is thus in error by the amount that the local longitude differs from its mean value. The error becomes increasingly noticeable at higher latitudes.

The time correction due to polar variation is called P.V., and is defined by the expression:

$$\begin{aligned} \text{P.V.} &= (X \sin \lambda - Y \cos \lambda)\ (\tan \phi)\ 1/15 \\ &= 0.0655\,X - 0.0169\,Y \text{ (for Ottawa)} \end{aligned}$$

where λ and ϕ are the adopted longitude and latitude of the time observing station. P.V. has been applied to the time results published at Ottawa since May 1954. It will be seen from the table that the amount of correction is sometimes as great as three hundredths of a second, a value which is appreciable when it is recalled that the daily rate of a first-class observatory timepiece is determined within one millisecond per day.

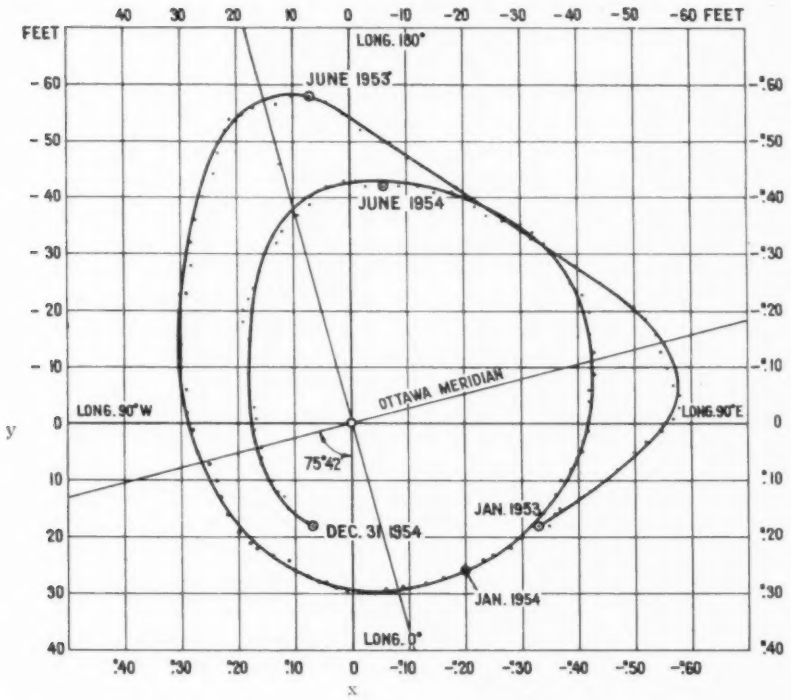

FIG. 1–Polar Motion 1854 from Ottawa PZT Observations.

NOTES AND QUERIES

International Geophysical Year, 1957–1958

Geophysics has many branches, and depends on international co-operation for an over-all understanding of its many problems. Already there have been two large international enterprises, the first and second International Polar Years, 1882–3 and 1932–3. During these years observations of the earth's magnetism, the aurora and meteorology were made at special stations established in the polar regions.

New techniques for studying ionospheric disturbances have been developed since 1933, for example the methods at radio frequencies. A proposal made in 1950 and 1951 for a third international year was approved by the International Council of Scientific Unions; in this case observations are to be made at all latitudes, not just in the polar regions, so that the enterprise is designated the International Geophysical Year. The "year" will extend from July 1957 to December 1958. Already thirty-six countries, including Canada, have offered to participate.

The interval since the second Polar Year is twenty-five years. In 1932 there was a minimum of sun-spot activity, whereas in 1957–8 there should be near-maximum activity. Because of the correlation between solar and terrestrial phenomena, a comparison of the observations at these two epochs should reveal valuable results.

The scope of the observations will be much wider than ever attempted before. The sun will be observed continuously by means of stations well distributed in longitude (special stations will have to be established to do this); the observations will include motion-picture patrols of the features as well as patrols at radio frequencies. Studies will also be made of cosmic rays, the aurora, airglow, geomagnetism, meteorology, glaciology and oceanography and even longitude and latitude determination.

For the study of the circulation of the atmosphere, in particular, three chains of stations are planned along the meridians at longitudes 80°W., 10°E. and 140°E. For geomagnetism studies and investigations of global weather the polar regions are being given special attention, with one station to be set up near the south pole and about a dozen stations south of the Antarctic circle. In the Arctic the zone of maximum auroral frequency is well placed for observation in Canada, and several temporary

stations are planned in Greenland. The equatorial region is also being intensively studied in connection with problems in geomagnetism, the ionosphere and cosmic rays.

Besides regular daily observations, concentrated observations are to be made at all stations on two days a month, to be called Regular World Days; one day will be at new moon, the other near quarter-phase. During each quarter ten consecutive days have been chosen for intensive meteorological observation for the study of atmospheric movements of longer duration; this interval is to be called a World Meteorological Interval. Plans are being made to alert the stations at times of unusual solar activity—a Special World Interval.

The International Geophysical Year will be the result of the most extensive international programme ever planned in science. It is certain that when all the observations are analysed, important knowledge will result.

R. J. N.

THE SUN

A great variety of techniques are used to study the sun, our nearest star: it is photographed in white light and in the light of such gases as hydrogen and calcium; motion pictures are taken; it is studied at a variety of radio frequencies. By comparing simultaneous observations of different kinds, astronomers are building up a picture of what happens on the sun. In the June 1955 issue of *Scientific American*, the Australian radio astronomer, A. J. Wild, gives an excellent summary of present-day ideas. Wild has been working in the field of radio astronomy in Australia since the war, and with L. L. McCready, was the first to develop a solar radio "spectroscope" which can respond to a wide range of frequencies; most radio telescopes detect radiation at just one frequency. The instrument used at present by the group in the Australian Commonwealth Scientific and Industrial Research Organization covers the range of frequencies from 40 to 240 megacycles/sec.

When a flare occurs in a hydrogen cloud on the sun, a surge prominence may be observed. At radio frequencies a "radio flash", lasting a few seconds, or an "outburst" lasting several minutes, may be recorded with the radio "spectroscope". As an outburst progresses it is found that the frequency of the radio signal decreases. It is suggested that this technique actually traces the movement of a cloud of ionized particles as it is ejected through the solar atmosphere (see this JOURNAL, vol. 47, p. 137, 1953).

The effects of a solar flare are soon felt on earth: in about an hour an increase in cosmic-ray intensity occurs, and in a day or so magnetic

storms and auroral displays may be observed. If these effects are caused by an ejection of particles from the sun, the first particles to cross the intervening 93 million miles must travel at a speed of about 30,000 miles/sec., whereas the slower-moving particles (causing the magnetic storms) must travel at about 1000 miles/sec. The radio observations show that outbursts invariably travel at a speed of between 100 and 1000 miles/sec., and the flashes move at about 30,000 miles/sec., in agreement with the above figures.

It is suggested that the above phenomena result from an explosion from the surface of the sun of fast particles moving at speeds approaching that of light; the passage of these particles through the corona causes the brief radio flashes, and when the particles reach the earth they may cause an increase in cosmic rays. Along with the ejection of the fast particles, a shock wave, carrying trapped particles, makes its way out through the corona at the slower speed of between 100 and 1000 miles/sec. Some of these particles reach the earth and may cause our auroral displays and magnetic storms. Wild also suggests an explanation for the appearance of the surge prominence and flare. His explanation of the whole series of phenomena shows great imagination and it is hoped that eventually more detailed observations will remove the uncertainties from his proposed theory.

R. J. N.

The Night-sky Spectrum of Venus

An interesting attempt was made recently at the Crimean Observatory by N. A. Kozyrev to obtain the emissional spectrum of the night-sky of Venus. Such a spectrum is observed in our atmosphere as a result of various molecular transitions, known as the Vegard-Kaplan bands, auroral lines, etc.

Because of Venus being closer to the sun than the earth the intensity of the glow of the night sky is about 50 times higher than on the earth. A spectrogram of Venus with the 50-inch astrograph of the Crimean Observatory disclosed a great number of molecular bands; some of the bands have not yet been identified. The known prominent features are the auroral bands of molecular nitrogen, N_2^+.

Two molecular bands in the ultra-violet part of the spectrum may be related to spots observed on Venus by Ross at the Mount Wilson Observatory in the year 1927. The spots were located in the vicinity of the equator and their intensity might have been related to changes of temperature. As a matter of fact, they have never been observed at the poles. Kozyrev makes a suggestion that this unknown polyatomic

molecule may play the role of water on Venus. At the poles, where the temperature is lower, the molecules must have condensed.

From the energy distribution of the radiation of the sun in the atmosphere of Venus the author was able to give a qualitative picture of its atmosphere. The temperature of the outer atmosphere is about −90°C. The presence of the CO_2 molecule would make the stratosphere practically non-existent, because of the higher effective absorption coefficient. At the surface the temperature would rise to + 30°C. The probable depth of the troposphere is of the order of 10 km. All changes of the weather take part in the higher layers of the atmosphere and in this region must originate also the observed emission bands of the night-sky.

G. A. B.

Honours Received

This year has brought honours to two of our contributors from the National Research Council. Dr. Gerhard Herzberg, Director of the Division of Physics, was elected an Honorary Fellow of the Indian Academy of Sciences "in recognition of his scientific eminence and of his outstanding contributions to knowledge". This is the first time that a Canadian has been given this honour; in fact the Indian Academy of Sciences has conferred this honour upon only about 40 men of learning since it was founded in 1934. Dr. Herzberg is well known for his work on atomic and molecular spectra, which has led to the detection of hydrogen in planetary atmospheres. Readers of this Journal will recall his paper on "The Atmospheres of the Planets" (vol. 45, p. 100, 1951).

Dr. Peter M. Millman, a regular contributor to this Journal, was awarded the J. Lawrence Smith medal by the National Academy of Sciences, in recognition of his work on the problems of meteor spectra. This medal has been awarded only four times since its establishment in 1884, and this is the first award to a scientist outside the United States. Dr. Millman has also been honoured by Harvard College: he has been appointed a Research Associate in the Harvard College Observatory. This is an academic honour which is awarded to outstanding scientists who have co-operated closely with Harvard research programmes.

R. J. N.

Supplement Series of the Astrophysical Journal

Recently the University of Chicago Press has distributed the first numbers of a new series. The *Supplement Series* will be published at irregular intervals as the need develops, and will consist of more ex-

tensive and specialized investigations than can be printed in the *Astrophysical Journal*. It is proposed that they will be collected into volumes of about 500 pages. The first volume is now completed, and consists of twelve numbers. It covers a wide range of topics: analyses of the spectral and light changes of certain variable stars, the nuclear reactions occurring in very hot stars, a catalogue and bibliography of emission-line stars of types later than B, the index of clumpiness of the distribution of images of galaxies, numerical integrations for the stellar interior, and others.

R. J. N.

ASTRONOMISCHER JAHRESBERICHT

Volume 52 of this valuable annual publication has been received by the Editor from the Astronomischen Rechen-Institut in Heidelberg. It lists and gives abstracts in German of all the astronomical literature of the year 1952, amounting to 13,438 papers altogether.

PAMPHLETS RECEIVED

During the course of time a number of pamphlets have been received by the Editor. These cannot be reviewed in detail, but are listed below:

Printed by the U.S. Department of Commerce, National Bureau of Standards: *Protection against Radiations from Radium, Cobalt–60, and Cesium–137*, Handbook 54; *Radioactive-waste Disposal in the Ocean*, Handbook 58; *Permissible Dose from External Sources of Ionizing Radiation*, Handbook 59; *Method for Determining the Resolving Power of Photographic Lenses*, NBS Circular 533.

French Biographical Digest, no. 12 (Series II), December 1954. This issue is devoted to astronomy in France, describing the work of the astronomers, details of the telescopes in use, and listing the French astronomical publications. The bulk of the 114-page booklet is devoted to a bibliography of selected books and articles by French astronomers.

Galaktozentrische Bahnelemente von 1026 Fixsternen in der nächsten Umgebung der Sonne by Karl Schütte, Springer-Verlag, Wien, 1952. A simple method of deriving the elements of the orbit of a star about the galactic centre is given, together with the elements and other data for 1026 stars.

Planetary Tables: Tables of Mercury by Harihar P. Bhatt, Sheth Bholabhai Jehingbhai Institute of Learning and Research, Research Series No. 43, Ahmedabad, 1953. The material in the pamphlet allows a relatively easy method of determining the geocentric positions of Mercury; the accuracy is a little lower than that obtained from Newcomb's Tables (now out of print). An English translation is included.

METEOR NEWS

By Peter M. Millman, *National Research Council, Ottawa*

Here and There in Meteoritics

It is encouraging to note that there are a number of interested groups across Canada keeping a watch on meteoric matters. Since he moved out to Edmonton from Montreal Mr. Earl Milton has been active in the Meteor Division of the Edmonton Centre of the Society. In addition to making observations of the stronger annual showers Earl has worked with Mr. I. McLennan, Mr. F. Loehde and Mr. A. Dalton in collecting and making preliminary reductions of the bright fireball which appeared east of Edmonton between 8 and 9 p.m. Sunday evening, Dec. 19, 1954. A recent communication from Edmonton informs me that the Meteor Division is currently investigating the bottom of a lake where a hole was made in the ice last winter by some object. The phenomena associated with the appearance of this hole make the fall of a meteorite a possibility.

The members of the Regina Astronomical Society have been observing meteors for some years now and in June they completed their fine new observatory. It is hoped to have a full account of the opening of this observatory in an early issue of the Journal. This group, under the leadership of Mr. John Hodges, has also collected a large number of observations of the Dec. 19 fireball. With the combined material from both Edmonton and Regina it should be possible to determine a good path for the object. The Regina Society has encouraged the formation of local groups in the neighbouring towns. One has already been organized in Moose Jaw and there are plans for the formation of others. The work of such groups will be invaluable in securing on the spot information of fireballs and possible meteorite falls.

I hear from Miss Isabel Williamson that the Meteor Section of the Montreal Centre will be in the field again this summer observing the Perseids. They expect to observe from Hemmingford, Que., a point well removed from city lights. Current activities of the Montreal Centre are described in their Monthly Newsletter, an excellent idea for keeping the members in touch with each other. I have all their Newsletters on file from a long way back and can heartily recommend to other centres of the Society the publication of such a bulletin.

Left—Mr. Brandon Barringer, *right*—Mr. Richard Barringer.

One of the pleasant events that occurred in Ottawa during the first week in July was a visit from some members of the Barringer family. On July 2 Mr. and Mrs. Brandon Barringer and Mr. Richard Barringer arrived in Ottawa for discussions at the Dominion Observatory on matters concerning meteor craters. It was Mr. Daniel Moreau Barringer, Senior who first, in 1909, seriously proposed a meteoric origin for the crater in Arizona which now bears his name. I had the pleasure of meeting Mr. Moreau Barringer, Jr., and his wife at the meteor crater in 1953, and I was very glad now to make the acquaintance of other members of the family. They had chartered a plane to fly to Brent, Ont., to look at the circular feature on the north border of Algonquin Park. This has been investigated by the Dominion Observatory over the last three years. I was invited to accompany them on this trip as there was an extra seat available in the aircraft. The chance to see the Brent Crater from the air was very welcome as from the ground there is no obvious evidence of its existence. From 10,000 feet up it stood out even more clearly than I had expected. We landed on Gilmour Lake, located inside the crater. In return for a very hot climb two years ago down and up across the Arizona Crater I was able to introduce the Barringer brothers to the difficulties of Canadian bushwacking during the black fly season. The complete story of the investigation of the Brent feature, which has much to suggest a meteoric origin, will appear shortly in the publications of the Dominion Observatory.

REVIEW OF PUBLICATIONS

Variable Stars and Galactic Structure by Cecilia Payne-Gaposchkin. Pages 114, 6¼ × 10 in. University of London, Athlone Press, 1955. Price $3.50.

Anyone interested in the many aspects of variable stars—the correlations of their physical qualities, and their relationships to one another—will find in this volume by Dr. Payne-Gaposchkin of Harvard a handy reference work. *Variable Stars and Galactic Structure* is based on lectures which the author delivered at the University of London in 1952. As co-author of an earlier, larger work on variable stars, Dr. Payne-Gaposchkin is eminently well qualified to summarize the most important aspects of this field.

The seven sections of the book deal with the galaxy, pulsating variables, explosive variables, magnitude scale, distribution of variables, motions, galactic structure and evolutionary problems. The chapter on pulsating variables is the most sumptuous since this is one of the fields in which the author is most eminent. Many of the figures in this chapter are drawn from the author's chapter in Hynek's *Astrophysics*, though without the references to original sources which helpfully caption the figures in that work. The book is rich in references at the end of each chapter, however, to a total of 171. Obviously care has been taken to make the book accurate, though a few misprints catch the eye, such as an erroneous N.G.C. number for 47 Tucanae on page 23.

There is practically no limit to the number of correlations which may be tried for variable stars, regarding absolute magnitudes, ranges, spectrum, galactic distributions, etc. This book contains a wealth of material on the more important of these relationships, represented in 54 tables and 44 figures. Diagrams such as Figure 5.4, distribution of RR Lyrae stars and Cepheids on the galactic plane, represent much work. We are grateful to the author for providing us with a compact source in which we can learn quickly what present observations show about the numerous relationships of variable stars.

H. S. H.

Eclipses in the Second Millenium B.C. and How to Compute Them in a Few Minutes by Prof. Dr. G. van den Bergh. Pages 102; 6¾ × 9½ in. Haarlem, H. D. Tjeenk Willink & Zoon's uitgevers Mij. N. V., 1954. Price f15 (Dutch guilders).

Studying the regularities and variations of solar eclipses, the author has presented in this book his results adapted to practical use by historians. He has found that it is possible to express the data defining a solar eclipse as a linear combination, with integer coefficients, of two basic periods—the *saros* and the *inex*. Further, methods are given to find the circumstances of an eclipse with the aid of Oppolzer's *Canon der Finsternisse*.

The book contains a preface and eight chapters: I, Introduction; II, Conditions to be satisfied by the periods; III, Secular variations of the elements; IV, The periods; V, Non-differential methods; VI, Differential methods; VII, Prédiction of eclipses after the year 2161 A.D.; VIII, How to compute a solar eclipse.

This study by Prof. Dr. van den Bergh will be a great help to historians. The writer thinks that it is the first time that a simple method has been given to non-mathematicians to compute eclipses. The simplicity of the present calculation is striking when one compares it, for instance, with Neugebauer's procedure as outlined in his book *Astronomische Chronologie*, which has been widely used.

The second part of the book, the lunar and solar eclipses as well as the iconographs, is a handy extension of Oppolzer's *Canon* to the period of 1600 B.C.–1207 B.C.

G. A. B.

NOTES FROM OBSERVATORIES

Dominion Astrophysical Observatory, Victoria, B.C.

Staff. In recognition of his contributions to the subject of stellar motions, the University of British Columbia conferred the honorary degree of Doctor of Science upon Dr. Joseph A. Pearce in May 1955, at which time Dr. Pearce gave the Congregation Address to the graduating class.

In June 1955 G. J. Odgers received the degree of Ph.D. in Astronomy from the University of California at Berkeley. Dr. Odgers attended the Pasadena meetings of the Astronomical Society of the Pacific in June, presenting three papers from members of the Observatory staff.

Dr. R. M. Petrie attended the meetings of the Royal Society of Canada held in Toronto in June. Five papers from the Observatory were read at the meetings. Dr. Petrie also attended meetings of the Council of the Royal Astronomical Society of Canada in Toronto, and *en route* home he addressed the Winnipeg Centre of the Society.

Dr. A. McKellar, Dr. K. O. Wright, and Dr. A. B. Underhill attended the meetings of the International Astronomical Union held in Dublin in August.

The following held temporary appointments at the Observatory during the summer:

Dr. R. O. Redman of Cambridge, England; Dr. S. G. Hacker, Washington State College, Pullman, Washington; P. M. Cuttle, University of British Columbia; J. D. Francis, University of British Columbia; A. K. Goodacre, University of British Columbia; D. Robinson of Queen's University, Belfast and the University of Western Ontario.

Instruments. A photoelectric exposure meter designed for the Observatory spectrograph by Prof. J. B. Warren of the University of British Columbia is now being tested. This exposure meter subtracts a few per cent. from the star-light after it enters the spectrograph slit and measures its intensity by means of a photoelectric cell. The meter then tells the observer when the exposure has been sufficient to give the desired density on the spectrogram. It is expected that after the exposure meter has been tested and calibrated, all exposure times will be determined by the meter rather than by the judgment of the observer.

Visitors. Among the visitors to the Observatory during the early months of the year were Prof. O. Struve of the Astronomy Department at

Berkeley, California, and Dr. J. Locke and Dr. A. E. Scheidegger of the Dominion Observatory. Prof. Struve's one-week visit was an enjoyable and profitable experience for all of the staff, not only because of the seminars he gave but also because of the informal discussions with him on the astronomical work in progress at the Observatory.

About sixty members attending the National Convention of the Astronomical League held in Seattle at the end of June visited the Observatory on the evening of July 4. Dr. Petrie was a visitor at the Convention in Seattle, addressing the delegates at the banquet meeting.

J. K. M.

VARIABLE STAR NOTES

American Association of Variable Star Observers

By MARGARET W. MAYALL, *Recorder*

A very successful Spring Meeting of the A.A.V.S.O. was held in Pittsburgh on the week-end of May 27, 1955 with about 70 members and guests present. Papers presented at the meeting included an evening lecture by Dr. N. E. Wagman on "Flare Stars"; "Some Comments on Variable Star Observing" by Robert M. Adams; "Who Wants to Find a Nova" by George Diedrich; "Secondary Observation of a Variable" by R. Newton Mayall; "On Observing Flare Stars" by Gunnar O. Darsenius; "An Electronic Idea" by Morgan A. Thomas; "The Predicted Light Curve of R Geminorum" by Margaret W. Mayall; "North to the Eclipse" by Jay Kunze, Robert Kemper and Adam Ott; and "The IGY and the Amateur" by Harry L. Bondy. We were particularly pleased to have the participation of two distant members, with papers sent by Darsenius from Gotenburg, Sweden, and by Thomas from Winslow, Washington. Abstracts of the papers have been distributed to members. A limited number of copies are available for distribution and may be secured by sending a request to headquarters, accompanied by a stamped, self-addressed envelope.

The following 23 new members were elected by the Council: Jim Breckinridge, Cleveland Heights, Ohio; Burnell R. Brown, Jr., Dallas, Texas; George T. Burr, Sidney, Nebraska; Dale P. Cruikshank, Des Moines, Iowa; Dan Davis, Jr., Austin, Texas; Edward DeGennaro, New York, New York; Peter Feller, North Arlington, New Jersey; Philip Goldenblatt, Bronx, New York; Wallace M. Klinck, Medicine Hat, Alberta; B. W. Koeppel, Tulsa, Oklahoma; Thomas D. Martin, Tarsana, California; Charles R. Michael, Bucyrus, Ohio; Robert H. Miller, Baltimore, Maryland; Mrs. Robert H. Perley, Fort Bragg, North Carolina; Robert J. Pivonka, King Salmon, Alaska; Ernest Seaquist, Cloverdale, British Columbia; Carl H. Schmidgall, Peoria, Illinois; Leonard Solomon, Brooklyn, New York; John A. Sperry, Jr., Tallmadge, Ohio; Helen M. Stephansky, Jamaica Plain, Massachusetts; John P. Weaver, Lancaster, Pennsylvania; Tom Waskiewicz, Inkster, Michigan; and Samuel L. Terry, Lancaster, Pennsylvania, was named an associate until he reaches the lower age limit (16) for annual membership. In addition, Gilbert Matthews, New York, New York, changed from annual to life membership, and the following transferred from annual to sustaining membership: Edward Oravec, New York, New York; Ralph N. Buckstaff, Oshkosh, Wisconsin; Leland M. Haines, Elkhart, Indiana; William A. Miller, Glen Rock, New Jersey; George S. Mumford, III, Dover, Massachusetts; Robert E. Pearcy, Indianapolis, Indiana; Theodore R. Treadwell, Arlington, New Jersey; and Thomas L. Trotter, Culver City, California.

203501 *AE Aquarii*

The month of July 1952 was designated as AE Aquarii Month for members of the A.A.V.S.O. Fortunately, the variable showed much activity during the summer of 1952, and was a very satisfactory object to observe. In several instances, three

maxima were observed within a 24-hour interval, thanks to our observers in Sweden, South Africa, United States and Australia. These observations do not confirm the radial-velocity period of 0.7 day.

During the current observing season, we have received reports of two well-observed flares of AE Aquarii. The first one, in April, observed by R. P. deKock at the Cape Observatory in South Africa, was a rapid flare, lasting about 6 minutes in all. His observations, in Universal Astronomical Time, are as follows:

1955 April 27,	1409	U.A.T.,	11.5	magnitude
"	1411	"	10.9	"
"	1412	"	10.7	"
"	1415	"	11.3	"

The second flare of AE Aquarii was observed by Curtis Anderson in Minneapolis, Minnesota. It was a much slower flare, and took nearly an hour to reach maximum. Mr. Anderson's observations are shown in the accompanying light curve.

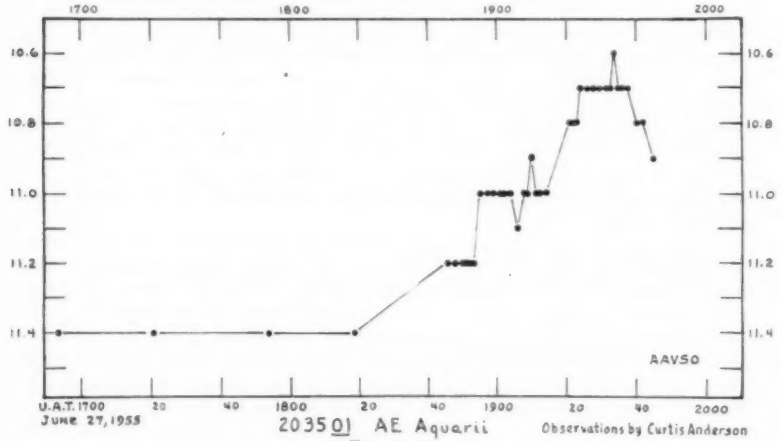

FIGURE 1

105259 *AG Carinae*

In the 1955 International Astronomical Union Draft Report for Commission 29 on Stellar Spectra, there is a note about the current work by Dr. Livio Gratton of the Eva Peron Observatory, Argentina, on the irregular variable, AG Carinae. Dr. Gratton wrote that it is "a very interesting object of the P Cygni type. Its spectrum varied from A2e to B5e (approximately) from 1949–50 to 1953. It would be interesting to know whether the magnitude changed as well (the radial velocity did). We suspect a small change in 1952 or early 1953."

I called attention to the recent peculiarities of this star in the Variable Star Notes in the previous issue of this JOURNAL (vol. 49, no. 4). While looking over some old variable star report blanks, I found some earlier observations of AG Carinae which I believe were never published.

Three groups of observations are plotted in figure 2. The top light curve is composed of observations made by A. W. J. Cousins of Durban, South Africa in

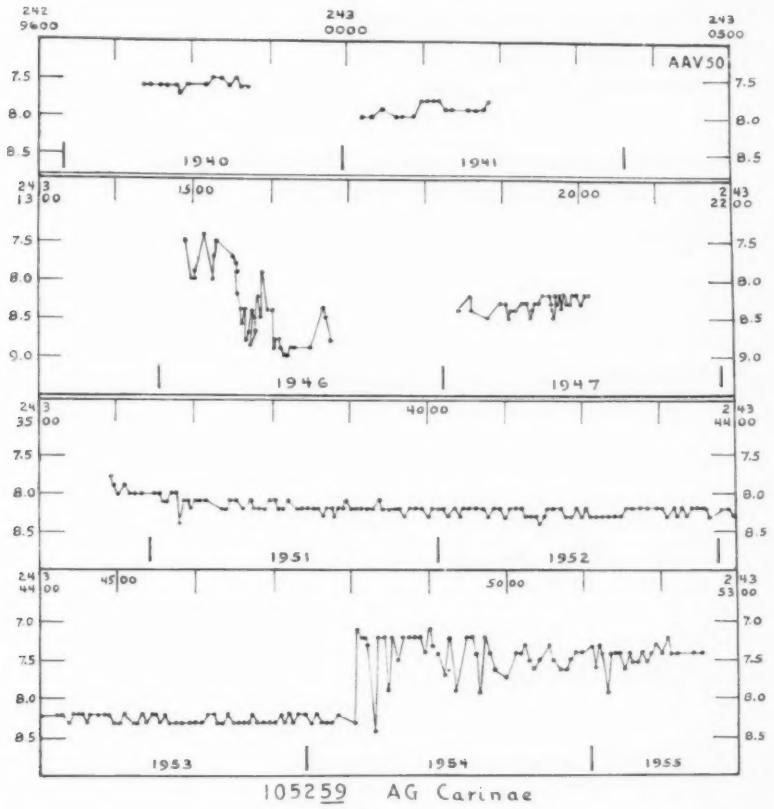

FIGURE 2

1940 and 1941. The second curve shows observations by Herbert Luft in São Paulo, Brazil during 1946 and 1947. The bottom curves are of observations made by R. P. deKock of the Cape Observatory in South Africa from 1950 to June 1, 1955. Mr. deKock's continuous series of observations show that the star did not vary more than a few tenths of a magnitude, visually, for about 1200 days. It was constant between 8.2 and 8.3 at the time Dr. Gratton observed the change in spectrum. The sudden change in visual brightness did not occur until the first week of March 1954. It will be interesting to know if further spectral changes took place at that time.

AG Carinae was studied on photographs at the Harvard College Observatory by Mrs. Naomi K. Greenstein in 1938, and later by Sergei Gaposchkin. They both found a slow variation of somewhat over one magnitude, but no indication of such a sudden, rapid change as occurred early in 1954.

Observations received during May and June 1955: In May 61 observers contributed 4,904 observations, and in June, 52 submitted 5,427—a total of 10,331 from 71 observers for the two months.

	May		June			May		June	
	No. Var.	No. Ests.	No. Var.	No. Ests.	Observer	No. Var.	No. Ests.	No. Var.	No. Ests.
Abbey, L. B., Jr.	3	3	5	5	James, R.	14	17	...	...
Adams, R. M.	62	160	44	152	Kastin, H.	61	62	...	...
Alvarez, H.	...	...	1	1	Kelly, F. J.	11	12	11	11
Anderson, C. E.	174	260	172	325	Kimball, M.	22	24	26	38
Archer, S.	12	49	...	...	deKock, R. P.	134	605	139	541
Aronowitz, C.	98	150	170	218	Lacchini, G. B.	21	79	39	146
Ball, A. R.	6	6	...	...	Maran, S. P.	72	124	54	68
Beidler, H. B.	49	113	26	67	McPherson, C. A.	...	...	12	12
Bicknell, R. H.	10	40	17	142	Mebius, W. G.	...	...	7	11
Blunck, V. H.	...	...	4	8	Melville, E. C.	...	...	7	8
Boutell, H. G.	7	17	7	18	Miller, W. A.	1	1	24	28
Breckinridge, J.	...	...	1	2	Montague, A. C.	37	58	42	69
Buckstaff, R. N.	8	13	14	26	Morgan, F. P.	11	28	4	8
Carlisle, J. H., III	4	10	1	6	Oravec, E. G.	110	188	160	366
Cragg, T. A.	77	81	144	150	Overbeek, M. D.	72	263	...	...
Cruikshank, D. P.	...	...	1	4	Parker, P. O.	53	53	18	18
Dafter, R.	5	40	...	...	Pearcy, R. E.	3	3	6	6
Dalton, A.	2	3	...	...	Peltier, L. C.	22	105	27	51
*Darsenius, G.	20	108	17	19	Perry, W. L.	3	4	...	...
Davis, D., Jr.	5	5	5	5	Renner, C. J.	155	199	181	254
Diedrich, DeL.	1	1	...	...	Rick, L.	2	2	2	2
Diedrich, G.	1	3	5	7	Rizzo, P. V.	9	13	15	29
Elias, D. P.	...	...	104	503	Rosebrugh, D. W.	18	46	10	65
Erpenstein, O. M.	...	...	1	2	Rosenfield, D. A.	3	3	...	...
Estremadoyro, V. A.	4	4	...	...	Royer, R.	12	13	11	11
Fernald, C. F.	118	262	125	266	Schultz, G. W.	29	79	45	89
Ford, C. B.	34	34	120	127	Segers, C. L.	15	37	8	26
Gaustad, J. E.	27	27	...	...	Skaritka, P.	135	288	175	408
Goldenblatt, P. P.	53	110	51	117	Solomon, L.	161	265	114	248
Goodsell, J. G.	1	1	...	...	Sturgis, H. E.	7	7	...	...
Greenley, R. M.	...	...	8	8	Taboada, D.	60	114	55	70
Halbach, E. A.	6	6	...	...	Venter, S. C.	72	281	...	...
Hartmann, F.	102	104	138	233	Wyckoff, J.	23	29	29	57
Hein, G.	160	237	165	369	Zahner, D.	4	4	6	7
Hiett, L.	6	18	...	...	Zelvin, J.	6	6	...	...
Jahn, A.	8	27	...	...					

*Also 44 minutes DO Cephei. 16 minutes BD +55° 1923.

Nova Search Reports

The new chairman of the Nova Search Committee, George Diedrich, has devised a new and shorter system for listing the nova search reports, by counting them on an "area-night" basis. Each time an observer checks a region, he is given credit for one area-night observation. The detailed reports are kept on file and can be referred to at any time. The following summary lists the work of 8 observers through May 1955, and includes some older unpublished observations made by Victor Blunck during 1954.

VICTOR BLUNCK: 1954: July, Aug., Sept., Oct.—Regions: 8, 9, 10 observed 21 area-nights.

1955: May—Regions: 8, 9, 10 observed 3 area-nights.

GUNNAR DARSENIUS: March, April—Regions: Dome, 16, 17 observed 25 area-nights.

GEORGE DIEDRICH: May—Regions: Dome, 56, 78 observed 8 area-nights.

EARL MILTON: May—Region: 10 observed 13 area-nights.

BEAUFORT S. RAGLAND: March, May—Regions: 23, 56, 71, 160 observed 47 area-nights.

LOUIS RICK: May—Regions: Dome, 18, 63 observed 8 area-nights.

DAVID W. ROSEBRUGH: March, April—Regions: Dome, 1, 34 observed 25 area-nights.

WM. H. SULLIVAN: Feb., March, May—Regions: 9–12, 18–22, 30–38, 46–74, 80–84, 91–94, 101–105, 110–112 observed for grand total of 1317 area-nights.

1955 Annual Meeting

The annual meeting of the A.A.V.S.O. will be held in Springfield, Massachusetts on October 21–23, at the cordial invitation of Mr. Leo Otis, Director of the Museum of Natural History. John E. Welch is the local chairman, in charge of arrangements.

A.A.V.S.O. Headquarters,
4 Brattle Street,
Cambridge 38, Massachusetts,
July 1955.

MEETINGS OF THE SOCIETY

AT OTTAWA

November 16, 1954—The meeting was held in the lecture hall of the National Museum. The President, Dr. J. L. Locke, introduced the speaker, Mr. G. A. Brealey, of the Dominion Observatory, who spoke on "Meteor Observing in North-western Canada".

The photography of meteors is undertaken largely to obtain information about the upper atmosphere of the earth at heights of about 60 miles above the surface. The Dominion Observatory operates two stations at Meanook and Newbrook, Alberta, where meteor photography is conducted on every suitable night. Mr. Brealey described the first phases of the programme which began in 1951.

The heights and decelerations of meteors can be determined if the same meteor is photographed from two stations (in this case 25 miles apart), and if the trails have been broken into segments by a rotating sector in the camera system. The two meteor observatories employ Baker Super-Schmidt cameras which were specially designed for meteor photography. They combine a wide field over 50 degrees in diameter with extreme speed, and hence they are able to photograph meteors which are too faint for more normal cameras. One complication is that the focal surface is part of a sphere of about 8-inch radius, so the film has to be specially molded to this curvature, and is then held in place in the camera by a vacuum system. The cameras are aimed so that the fields intersect at a height of about 60 miles, in order to photograph the same meteors with both cameras. It is often necessary to choose a part of the sky where the aurora is faint, for the extreme speed of the cameras makes them susceptible to rapid fogging by either aurora or moonlight.

In addition to the Super-Schmidt cameras the two meteor observatories operate several smaller cameras equipped with gratings, in order to obtain meteor spectra which yield information about the composition of meteors and the atmosphere. Good meteor spectra are very difficult to secure but the Alberta stations have already produced some of the best ones known.

Mr. Brealey illustrated his lecture with slides of the observatories showing various stages in the construction of both buildings and equipment. Dr. J. A. Rottenberg thanked the speaker for his interesting and amusing report on the meteor observing programme.

December 2, 1954—The annual dinner meeting was held in the cafeteria of the Experimental Farm. A total of 113 members and guests attended.

Following the dinner itself a short business meeting was held which included the election of officers for 1955. The President, Dr. J. L. Locke, then introduced the speaker, Mr. W. S. McClenahan of the Dominion Observatory, who spoke on "Re-opening of the Pulkovo Observatory, Leningrad, U.S.S.R." An account of this talk is given elsewhere in this JOURNAL.

Mr. McClenahan illustrated his talk with numerous slides of the places visited. Mr. J. E. Lilly moved a vote of thanks in appreciation of the most interesting account of the speaker's trip to Russia.

IAN HALLIDAY, *Secretary*.

AT MONTREAL

August 21, 1954—Stellafane Convention. Several members of the Montreal Centre journeyed to Springfield, Vermont, on Saturday August 21st to attend the convention of Amateur Telescope Makers held on top of the near by mountain, Mount Porter, at Stellafane. There was an exhibition of different types of Telescopes. A testing apparatus for optical surfaces good to 1/100 of a wave-length was shown by Mr. MacIntosh of the Hayden Planetarium. Some of the telescopes had unique features.

Montreal Centre was represented by Mr. A. M. Donnelly and mother, Mr. and Mrs. Darling, Gordon Bloom, Richard Venor and Robert Venor. An interesting feature of the convention was a visit to the Comparator Division of Jones & Lampson.

At the final meeting, the various organizations represented were identified, and the M.C., Mr. Flanders, paid a high compliment to the Montreal Centre for its accomplishments, "Montreal people really do observe".

EDWIN E. BRIDGEN, *Recorder.*

REPORT OF THE DIRECTOR OF OBSERVATIONS FOR 1953–54*
(Summary)

Five years ago the Observations Committee of the Centre organized our different observational activities into sub-committees with a member in charge of each sub-committee.

Occultations—Under the chairmanship of Mr. Charles Good, this section has successfully timed 18 occultations out of 65 scheduled as visible here. Their work has come to the attention of the Department of Mines and Technical Surveys, who have requested a copy of the results with the possibility of their being used for latitude and longitude computations.

Sun-spots—The sun has passed its minimum activity; the month which will probably be assigned as minimum month will be June 1954. There were seven months with negative reports, as well as two months which were practically negative. There was a flare-up in March, when a naked-eye group appeared, and another in August. Some small high-latitude spots have been reported, a sure indication of the beginning of a new cycle. During the year 21 groups have been observed with a total of 198 spots.

Planets—This section has been handicapped by poor weather. Observations of Jupiter during its last opposition gave poor results. Five observers sent in 14 observations of Mars around opposition time.

Aurorae—During the year 168 reports of aurorae have been received by the chairman, Mrs. C. Zorgo; the observations came from 18 observers, one of whom reports from Edmonton and another from Norway. There is little evidence of a lull in auroral activity during the minimum of sun-spot activity.

Eclipses—Under the chairmanship of Miss Isabel Williamson, this section has only failures to report because of clouds. Sixteen members of the Centre took a week off to travel 700 miles from Montreal to try to observe the solar eclipse of June 30, 1954 The party was well organized, but the sky was completely overcast at eclipse time.

*Reported at the Annual Meeting of the Centre, October 18, 1954.

Meteors—Miss Williamson and 22 of our members motored to Hemmingford on August 13 to observe the Perseid meteors. Because of full moon and some cloud, fewer than usual meteors were seen, but observations went on uninterruptedly from 10 p.m. to 4 a.m.

Sporadic Meteors—13 members of this section have reported and recorded 16 sporadic meteors. Mr. Bridgen is chairman of this section.

Telescope Makers—The activities of this group were suspended until the basement of the new building was ready for this work. This has now been completed, and Mr. Venor will again direct the amateur telescope makers.

Nocturnal Bird Migration—This is not an astronomical subject but is one that has called into use the Society's equipment and the interest of many members. Weather hampered observations. On May 15, from the Observatory, two hours of observation yielded 12 birds. On September 9 from Mr. DeKinder's observatory, we got two hours and saw 10 birds. On September 12 Mr. MacLennan from St. Lambert, observed for 3 hours and saw 22 birds, while from Miss Williamson's home she and others observed for 2 hours and saw 6 birds. On September 14 Mr. MacLennan observed for 2 hours and saw 14 birds; Miss Williamson and party saw 48 birds during 3 hours. On October 10 through clouds, with a total of only an hour and a half of observing time 60 birds passed across the lunar disk. Mr. G. H. Hall is chairman of this section.

Asteroid Club—This section is under the guidance of Mrs. F. Hall with assistance from Mrs. Zorgo, Miss Williamson and Mr. Good. Five classes of Girl Guides have been given instruction in astronomy and exams have been taken. Extension of this work is planned. The Star Night in Westmount Park on October 6 was rained out. Regular observation meetings were held on Saturday nights, rain or shine. If the sky was overcast the group held an informal indoor meeting. The editing and printing of "Skyward" is an important part of the operations of this Centre. Miss Williamson, who is editor and copywriter of this paper is to be warmly congratulated for her devotion to this work through the six years since "Skyward" first appeared. Mr. Charles Good has seen that the paper is printed and distributed.

Observatory—Last year the Centre received the donation by McGill University of a building for use as an observatory. Since then the Council of the Centre have bent every effort in putting the building in shape for its use for our purposes. Contracts have been placed and work on the building has been done and is still in progress. A goodly sum of money has been contributed by our members towards this work. More is needed to complete the building as we would like to have it.

FRANK J. DEKINDER, *Director of Observations.*

November 8, 1954—The regular meeting of Montreal Centre was held at MacDonald Physics Building, McGill University. The chair was taken by the President, Mr. Chas. M. Good. The President announced that regular observation meetings would be resumed on Saturday evenings at the new building. The work on the observatory was sufficiently advanced to permit of its being used, although funds were insufficient to complete the dome.

Mr. W. H. Birtles gave the first of the Introductory Series of lectures for the season 1954–55, his subject being "The Sun". Without the light and heat of the sun, our world would be frozen and lifeless. Astronomically the sun is a star, the only one which can be studied at close range.

A description was given of solar activities—spots, prominences, corona, and of

its physical condition and proportions. The energy radiation is believed to be maintained by a cycle of reactions between the elements hydrogen, nitrogen, carbon and helium. Solar radiation is the source of all energy on this planet, with minor exceptions which could not have appeared without the sun.

EDWIN E. BRIDGEN, *Recorder.*

AT EDMONTON

March 11, 1954—The meeting was called to order at 8.20. The President, Dr. Grayson-Smith, was in the Chair.

The Handbook talk was given by Dr. Campbell.

The report on the observers group was given by Earl Milton, who showed graphs of the number of days per month in 1952 and 1953 on which aurora were observed. Some questions were asked from the audience and the difficulty of interpreting results on the basis of a small number of observations was pointed out.

The main paper was given by Dr. W. C. Wonders of the newly established sub-Department of Geography. He took as his topic the subject "Maps in Geography".

The speaker introduced his topic by a brief summary of the close relationship between geography and astronomy, emphasizing that both were chorological studies, the one concerned with the arrangement of things on the earth's surface, and the other with the arrangement of things in the universe. The map is the prime tool of the geographer. The development of this tool reflects significantly the developments in the field of geography generally and also to a considerable extent the developments in the fields of mathematics and astronomy. The speaker then summarized the evolution of maps from their earliest known forms in Babylonia (2300 B.C.) through the classical and medieval periods, to the renaissance in cartography in the late 15th century and the emergence of the modern era in the 18th century.

There were 20 members and visitors present.

April 8th, 1954—The meeting was called to order at 8.20 p.m. by the President, Dr. H. Grayson-Smith.

The Handbook talk was given by Dr. Campbell.

Earl Milton reported for the observers group. Occultations are being started. Meteors are to be observed from April 19 to 23 at Meanook, and the group will do as much as possible here in Edmonton. The small sun-spot group of January 8 was seen in Greece and U.S.A. by two other observers.

The main paper was by Dr. D. R. Crosby of the Department of Mathematics on the subject "Solar Eclipses and the Accurate Determination of Longitude." The speaker showed by diagrams and models (not to scale) how the sun, earth and moon are located in space to produce a total solar eclipse, and explained why this is visible as total over only a small part of the earth's surface. He described the type of observation which led to the recognition of the Saros, or 19-year period connecting eclipses of a given sequence. This generalization was used in the earliest predictions of eclipses.

The general problem of longitude determination was discussed, indicating how difficult it is to measure accurately the amount Washington is west of Greenwich. The main thing involved is accurate timing, and the total solar eclipse gives an added method of improving this accuracy.

There were 27 members and visitors present.

May 13, 1954—The meeting was called to order at 8.25 in Room 111, Arts Building.

Handbook talk by Dr. Campbell as usual.

Observers group report was given by Ian McLennan. The Auroral division was active. The weather was not good enough for meteors, but a few were seen.

Plans are being made for eclipse observations at and after sunrise on June 30, from the Macdonald Hotel roof.

The main paper was given by Mr. Bill Wilson on "The Eclipse of June 30, 1954". General data: Start in Minnesota (sunrise)—Northern Ontario, Labrador, Greenland, Sweden, Poland, Georgia, Pakistan and finish in India (sunset). 2½ minutes in Sweden, 1½ in Canada, is duration of totality.

Some of the special features were then discussed—the *flash spectrum* is due to narrow slit of light just before totality. It gives information about condition of various layers of solar atmosphere, and the heights at which they occur. Three Canadian parties are to study this at three locations on the centre of totality.

The solar corona is observable only during totality. A 10 km./sec. velocity has been fairly reliably measured. The general shape varies with degree of sun-spot activity. Spectra of the corona show bright line, continuous, and dark line types. Polarization of coronae light was found to be radical. A Canadian party will study this.

Geodetic problems include accurate measurements of the earth's size and shape. Accurate timing of the instant of totality at two known places on the earth's surface, coupled with accurate knowledge of the speed of the shadow can be used to check the path length.

Relativity theory tests. Bending of a light ray in a strong gravitational field is due to the quantum energy having an effective mass. Einstein's prediction of bending was first checked in 1919 during a total eclipse.

Radio-wave propagation tests will be taken in Canada, to find out more about the ionization of the upper atmosphere.

Aurorae during totality will be observed and compared with similar types observed at night, to try to find out more about the true nature of aurorae.

There were 22 members and visitors present.

E. H. Gowan, *Secretary.*

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